

**Summer Research for Women in
Mathematics 2019 H98230-19-1-0119**

Dr. Hélène Barcelo

May 17, 2019 – May 16, 2020

A. Introduction

The MSRI project, Summer Research for Women in Mathematics (SWiM) is part of MSRI's overall activities aimed at strengthening the mathematical sciences by facilitating research and professional activities leading to or enhancing successful, productive careers. As part of this goal, it is important to recognize that for some populations inequities exist and need to be redressed. For some, a remedy is to increase the visibility and impact of their research, for others it is to increase their productivity. This program has been aimed at creating a rewarding and collegial environment that furthers success, benefiting the mathematical community at large. Responses to the exit survey reveal that the program was successful in working toward this goal; when asked about their level of professional satisfaction with MSRI, 88% of respondents gave a rating of 5 out of 5. MSRI is also gratified to see that 93% of respondents gave a 5 out of 5 rating to the administrative support they received.

The present grant provided space and funds for 13 groups of women researchers to work on a research project for one or two weeks at MSRI during the summer of 2019. Each group was comprised of between 2 and 6 researchers, with a total of 46 women participating overall. These were research projects that had already been started, perhaps at a conference such as Women in Topology, Women in Numbers or could be freestanding activities.

As part of their application package, the groups were asked to provide bio sketches, a brief history of the collaboration, the context and description of the research problems to be addressed, partial results already obtained, realistic goals to be achieved during the residence at MSRI, and plans for research that will occur before, during and after their stay at MSRI.

Factors in choosing the groups included: scientific merit of the project, the likelihood of finishing the project within the timeline specified in the application, and the extent to which this opportunity will enhance the project, for example by bringing together researchers from different institutions.

B. NSA Financial Summary

Financial Summary
Summer Research for Women in Mathematics
 June 10 - August 2, 2019
 MSRI, Berkeley, CA, USA

	NSA	Total
Travel	\$ 14,672.50	\$ 14,672.50
Meals Allowance	\$ 6,184.00	\$ 6,184.00
Lodging	\$ 32,764.29	\$ 32,764.29
Food	\$ 5,386.03	\$ 5,386.03
Post Program Travel		\$ -
Childcare		\$ -
Misc		\$ -
Total	\$ 59,006.82	\$ 59,006.82

		Travel	Meals Allowance	Lodging	Food	Totals
		NSA	NSA	NSA	NSA	
Participants	Citizenship					
Akhari, Shabnam	United States PR					\$ -
Aktas, Kevser	Turkey					\$ -
Beyarslan, Selvi	Turkey					\$ -
Biermann, Jennifer	United States	\$ 553.30				\$ 553.30
Biggs, Kirsti	United Kingdom					\$ -
Cladek, Laura	United States	\$ 341.43	\$ 225.00			\$ 566.43
Davey, Elizabeth Bla	United States PR	\$ 599.49	\$ 300.00			\$ 899.49
Duwentig, Anna Luise	Germany					\$ -
El Khoury, Sabine	United States		\$ 300.00			\$ 300.00
Emory, Melissa	United States					\$ -
Evans, Emily	United States	\$ 295.07				\$ 295.07
Francis, Amanda	United States	\$ 610.30	\$ 300.00			\$ 910.30
Friedlander, Holley	United States					\$ -
Fuchs, Elena	United States					\$ -
Gillaspy, Elizabeth	United States	\$ 616.00				\$ 616.00
Goodson, Heidi	United States					\$ -
Grotheer, Rachel	United States	\$ 624.00	\$ 325.00			\$ 949.00
Hamieh, Alia	Canada					\$ -
Harada, Megumi	United States	\$ 594.77	\$ 300.00			\$ 894.77
Harron, Piper	United States	\$ 600.00				\$ 600.00
Hsu, Catherine	United States		\$ 300.00			\$ 300.00
Li, Shuang	China					\$ -
Lin, Kuei-Nuan	United States PR	\$ 600.00	\$ 300.00			\$ 900.00
Ma, Anna	United States	\$ 250.00	\$ 325.00			\$ 575.00
Miller, Claudia	United States	\$ 363.60	\$ 300.00			\$ 663.60
Morse, Jennifer	United States	\$ 658.17	\$ 250.00			\$ 908.17
Needell, Deanna ¹	United States	\$ 320.00	\$ 325.00	\$ 1,181.31		\$ 1,826.31
Norton, Rachael	United States	\$ 562.89	\$ 15.00			\$ 577.89
O'Keefe, Augustine	United States	\$ 600.00	\$ 269.00			\$ 869.00
Petersen, Kathleen	United States					\$ -
Precup, Martha	United States	\$ 608.80				\$ 608.80
Qin, Jing	China					\$ -
Rajan, Priyanka	United States PR	\$ 119.97				\$ 119.97
Reznikoff, Sarah	United States	\$ 619.89	\$ 300.00			\$ 919.89
Rizo Carrion, Noelia	Spain					\$ -
Schaeffer Fry, Amand	United States	\$ 594.33	\$ 300.00			\$ 894.33
Schilling, Anne	United States	\$ 76.21	\$ 250.00			\$ 326.21
Searle, Catherine	United States	\$ 616.38				\$ 616.38
Secoleanu, Alexandra	United States	\$ 622.52	\$ 300.00			\$ 922.52
Sega, Liana	United States PR	\$ 401.20	\$ 300.00			\$ 701.20
Stange, Katherine	United States					\$ -
Taylor, Krystal	United States	\$ 868.02	\$ 300.00			\$ 1,168.02
Thompson, Lauren	United States	\$ 624.64	\$ 300.00			\$ 924.64
Tymoczko, Julianna	United States	\$ 710.92	\$ 300.00			\$ 1,010.92
Vallejo Rodriguez, Carolina	Spain					\$ -
Wright, Sarah	United States	\$ 620.60				\$ 620.60
Subtotals (Participants)		\$ 14,672.50	\$ 6,184.00	\$ 1,181.31	\$ -	\$ 22,037.81
Dormitory				\$ 31,582.98		\$ 31,582.98
Lunch					\$ 5,386.03	\$ 5,386.03
Teas						\$ -
Breakfast with Director						\$ -
Recruiting						\$ -
Materials and supplies						\$ -
Misc.						\$ -
Subtotals (Other)		\$ -	\$ -	\$ 31,582.98	\$ 5,386.03	\$ 36,969.01
Totals		\$ 14,672.50	\$ 6,184.00	\$ 32,764.29	\$ 5,386.03	\$ 59,006.82

Participants stayed in shared apartments on the campus of UC Berkeley, and were provided with reimbursement of travel expenses

Participants were provided with breakfast at the campus dining hall. They had the choice to either have dinner at the dining hall or receive a meals allowance of \$25 per day

¹ Participant stayed in a hotel off campus, and was reimbursed the amount MSRI would have spent at the dormitories

C. Summary of Participant Demographics

Officially Registered Participants Information

Participants		46
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Gender		46
Male	0%	0
Female	100%	46
Declined to state	0%	0

Ethnicity*		46
White	78%	36
Asian	11%	5
Hispanic	0%	0
Pacific Islander	0%	0
Black	2%	1
Native American	0%	0
Mixed	7%	3
Declined to state	2%	1

* ethnicity specifications are not exclusive

Participants		
First Name	Last Name	Institution
Shabnam	Akhtari	University of Oregon
Kevser	Aktas	Gazi University
Selvi	Beyarslan	University of South Alabama
Jennifer	Biermann	Hobart and William Smith College
Kirsti	Biggs	University of Bristol
Laura	Cladek	University of California, Los Angeles
Blair	Davey	City College, CUNY
Anna	Duwenig	University of Victoria
Sabine	El Khoury	American University of Beirut
Melissa	Emory	University of Toronto
Emily	Evans	Brigham Young University
Amanda	Francis	Mathematical Reviews
Holley	Friedlander	Dickinson College
Elena	Fuchs	University of California, Davis
Elizabeth	Gillaspy	University of Montana
Heidi	Goodson	Brooklyn College, CUNY
Rachel	Grotheer	Goucher College
Alia	Hamieh	University of Northern British Columbia
Megumi	Harada	McMaster University
Piper	Harron	University of Hawaii at Manoa
Catherine	Hsu	University of Bristol
Shuang	Li	Colorado School of Mines
Kuei-Nuan	Lin	Pennsylvania State University
Anna	Ma	University of California, San Diego
Claudia	Miller	Syracuse University
Jennifer	Morse	University of Virginia
Deanna	Needell	University of California, Los Angeles
Rachael	Norton	Northwestern University
Augustine	O'Keefe	Connecticut College
Kathleen	Petersen	Florida State University
Martha	Precupp	Washington University
Jing	Qin	University of Kentucky
Priyanka	Rajan	University of Notre Dame
Sarah	Reznikoff	Kansas State University
Noella	Rizo Carrion	University of Valencia
Amanda	Schaeffer Fry	Metropolitan State University of Denver
Anne	Schilling	University of California, Davis
Catherine	Searle	Wichita State University
Alexandra	Secelaeanu	University of Nebraska
Liana	Sega	University of Missouri
Katherine	Stange	University of Colorado
Krystal	Taylor	Ohio State University
Lola	Thompson	Oberlin College
Julianna	Tymoczko	Smith College
Carolina	Vallejo	Autonomous University of Madrid
Sarah	Wright	Fitchburg State University

D. & E. Description of Conference Activities & Publications

Each research group worked on the projects outlined in their proposal. They met daily at MSRI, and many met in the evenings and weekends at the apartments reserved for them on the campus of UC Berkeley. Unfortunately, due to the COVID-19 pandemic, the groups have not all been able to reunite in person after the summer program but they have continued to meet virtually to further their research. When travel again becomes advisable, MSRI will make travel funding available to facilitate continued in-person collaboration.

The following status updates have been provide to MSRI:

Akhtari, Aktas, Biggs, Hamieh, Petersen, Thompson

Update from 5/27/20

We have some new results, and are currently working on the last stages of preparing an article, which will be submitted to a peer-reviewed research journal specialized in number theory. We are expecting to submit the article by the end of July 2020.

Beyarslan, Biermann, Lin, O'Keefe

Update from 10/25/19:

Algebraic invariants of weighted oriented graphs (<https://arxiv.org/abs/1910.11773>)

Update from 12/4/19:

We have submitted our first joint paper. We also started another project and we are using the extended support to work together. This will not be possible without the supports that we received at MSRI. Me and another group of researchers just submitted another application for this coming summer because of such positive experience I have. Thank you for all of the work you have done for this program.

Update from 5/22/20:

There is no change on the status of our submitted paper. The journal has not gave us any update since the submission.

Cladek, Davey, Taylor

Update from 3/7/20:

Upper and lower bounds on the rate of decay of the Favard curve length for the Cantor four-corner set (<https://arxiv.org/abs/2003.03620>). On the quantitative Besicovitch generalized projection theorem - In progress

Update from 5/26/2020:

This paper appears on the arXiv and is currently under review.

Duwenig, Gillaspy, Norton, Reznikoff, Wright

Update from 5/22/20:

Cartan subalgebras for non-principal twisted groupoid C^ -algebras (<https://arxiv.org/abs/2001.08270v2>) - Accepted for publication in Journal of Functional Analysis (10/1/20)*

El Koury, Miller, Seceleanu, Segal

Update from 6/20/20:

At the moment we do not have a completed paper to report. As you might recall, we were planning a follow up meeting for our group in Syracuse in late March. However, the time of our meeting turned out to coincide with university closures and travel bans due to the current health crisis and we had to cancel our plans. Due to this and the demands of the current situation on our time we have not had the chance to complete our project. We will keep you informed of our progress.

Evans, Francis

Update from 5/25/20:

Spanning 2-Forests and Resistance Distance in 2-Connected Graphs

(<https://arxiv.org/abs/1901.00053v3>) - Submitted on 5/15/19.

Resistance distance and spanning 2-forest matrices of linear 2-trees - submitted

Monotonicity of resistance distance in linear 2-trees - In progress, plan to submit by the end of June 2020

Katz similarity index comparisons - In progress, plan to submit by the end of summer 2020

Freidlander, Fuchs, Harron, Hsu, Stange

Update from 5/22/20:

We had a good meeting at JMM (and I spoke about the project there), but our group was really set-back this spring, mainly by COVID -- almost all of us had to give over most/all research time to childcare, and one of us had a personal loss. We are finding a bit of time now, and have overcome some outstanding research obstacles on the project, and hoping to get a final version of our paper together in the next months.

Goodson, Emory

Update from 5/22/20:

Sato-Tate Distributions of $y_2=xp-1$ and $y_2=x_2p-1$ (<https://arxiv.org/abs/2004.10583v1>) - Submitted 4/22/20

Grotheer, Ma, Needell, Li, Qin

Update from 12/5/19:

We have two papers submitted and are working on a third. It was a VERY productive two weeks.

Update from 5/22/20:

Stochastic Iterative Hard Thresholding for Low-Tucker-Rank Tensor Recovery

(<https://arxiv.org/abs/1909.10132v1>) - Submitted on 9/13/19

Iterative Hard Thresholding for Low CP-rank Tensor Models (<https://arxiv.org/abs/1908.08479>) - Submitted on 8/22/19

Tensor Iterative Singular Tube Hard Thresholding Algorithms - In progress

A Simple Recovery Framework for Signals with Time-Varying Sparse Support - In progress

We are currently working on applying our methods to COVID-19 problems, so the group is very much still active.

Harada, Precup, Tymoczko

Update from 12/5/19:

*Based on our work at MSRI, Martha Precup, Julianna Tymoczko, and I are currently completing work on a manuscript "Filtrations in the cohomology rings of regular nilpotent Hessenberg varieties" which is jointly authored with Tatsuya Horiguchi and Satoshi Murai. (We discovered *after* our MSRI visit that we were thinking about similar questions as Dr. Horiguchi and Dr. Murai and ended up collaborating with them.) The manuscript is nearing completion, and we hope to have a preprint available very soon (roughly within the next month).*

Update from 12/31/19:

I am writing to let you know that Martha Precup, Julianna Tymoczko and I have completed a research manuscript pertaining to one of the two main projects we started at MSRI during the SWiM program last summer (July 2019). It turned out that we joined forces with two other mathematicians who were thinking about the same problem, so the final paper has 5 authors. However, the ideas and conversations we had at MSRI made the final results possible. The paper is now posted on the preprint (ArXiv) server. We will keep you updated regarding the second of our two main projects.

A filtration on the cohomology rings of regular nilpotent Hessenberg varieties
(<https://arxiv.org/abs/1912.12892v2>) – Submitted on 3/11/20

Morse, Schilling

Update from 12/4/19:

A short version of the paper was also accepted as a poster for FPSAC2020: Jennifer Morse, Jianping Pan, Wencin Poh, Anne Schilling, Crystal for stable Grothendieck polynomials $S\backslash$ eminaire Lotharingien de Combinatoire (2020), to appear

Update from 5/29/20:

A crystal on decreasing factorizations in the 0-Hecke monoid (<https://arxiv.org/abs/1911.08732v3>) – Accepted for publication in [The Electronic Journal of Combinatorics](#)

Schaeffer Fry, Rizo, Vallejo

Update from 5/24/20:

Galois Action on the Principal Block and Cyclic Sylow Subgroups (<https://arxiv.org/abs/1912.05329>) – Submitted on 3/13/20

Groups with few p' -character degrees in the principal block (<https://arxiv.org/abs/2004.10261>) – Submitted on 4/21/20

Characters and Generation of Sylow 2-Subgroups ([preprint](#)) – Submitted on 5/24/20

By the way, since we work so well together thanks to the program, we are currently working on some new joint projects that have begun since our stay at MSRI!

Searle, Rajan

Update from 6/18/20:

Priyanka and I don't have a paper ready yet. Given the current situation with the pandemic, my plans to visit Priyanka during the summer have been postponed. I will be on sabbatical this coming academic year

and provided it is safe to travel and Priyanka's schedule permits, I was planning to try and visit her at some point during that time so that we could finish our work.

From the participants reports we can see that 10 of the 13 groups have already written up some of their results and posted their manuscript on the arXiv. So far, 13 papers were submitted, 2 have already been accepted, and the other eleven are awaiting referee's reports.

F. Conclusion

This program has been and continues to be a success. A selection of comments from the exit interviews shows the impact that this has had on the summer 2019 participants:

"I thought that this was a fantastic program. It was so useful to have the funds and time to work with my collaborators. The six of us normally reside in four different time zones, which makes it difficult to work over Skype. I don't think that we could have completed our project without these two weeks. I love that the mothers in our group were able to have childcare provided. It really gave us the ability to focus and stay productive throughout the two-week period."

"The most beneficial part was about being in the same place to work together without any distractions. My collaborators and I tried to meet weekly on Skype to work on our project since November but given our teaching/mentoring/service responsibilities at our institutions and our private life, our progress was slow. While we were at MSRI, we made so much progress in our project that would take us months if we kept working remotely with each other."

"Our group was able to learn about an area of research that was relatively new to almost all of us and to apply work we had done previously to this new and increasingly popular area. Since I work at a small teaching school, having two weeks of dedicated research time with collaborators that live far from me and receiving the funding to do so, is invaluable to helping me progress in my research."

"We felt less judged and found ourselves working much more openly - we were more willing to throw ideas out there, even if they were silly or didn't pan out. This helped stem creativity and led to success in the project that wouldn't have happened otherwise. Maybe this shouldn't be the case - we should just be confident to work this way all the time. I think this experience helped us realize that and has helped us gain more confidence in collaborating (together and with others) going forward in our careers."

"I met women researchers from other fields (participants in the other SWiM groups), building my support network. Many of the women participating in SWiM this summer had young children that accompanied them to MSRI; it was inspiring to see how these women are managing to balance family and research. I now have more role models and mentors that I can ask about how to achieve such a balance."

All groups are working on manuscripts for publication, some of which have already been submitted and accepted. Eighty groups in diverse fields (comprised of 294 women) applied for the 2020 program, up from 46 groups and 153 women who applied for the 2019 program. Unfortunately, due to the COVID-19 pandemic, MSRI has postponed the next iteration of the SWiM program until summer 2021. However, thanks to grants from private foundations, we have already been able to extend offers to 18 groups (82 women), which represents an increase of more than 30% above the number of 2019 participants.

Summer Research for Women in Mathematics 2019

July 22, 2019 - August 02, 2019

While at MSRI my research program was advanced in the following ways:

Q1. I had the opportunity to work in person with collaborators that I would not have otherwise		
Yes	43	100%
No	0	0%
Total Responses	43	

Q2. I moved an established project toward publication		
Yes	43	100%
No	0	0%
Total Responses	43	

Q3. My research was advanced in these other ways:

[Link to Qualitative Responses](#)

Q4. If your answer to any of the above set of questions was no, what opportunities should MSRI provide to mitigate this?

[Link to Qualitative Responses](#)

Q5. MSRI aims to provide a supportive environment for all program participants. How satisfied were you with this aspect of your experience?

1 - Least Satisfying	1	2%
2	0	0%
3	2	5%
4	4	9%
5 - Most Satisfying	36	84%
Total Responses (Exclusive of N/A)	43	100%

Q6. Programs meant to redress inequity are sometimes negatively perceived. These views need to be understood and addressed. Here are some examples. We would appreciate your comments, which will be kept anonymous.

[Link to Qualitative Responses](#)

Q7. What impact (anticipated or present) does this have on your career?

[Link to Qualitative Responses](#)

MSRI Experience - General Information

Q8. What aspects of the program, environment, facilities, and relationships with colleagues were most beneficial to you?

[Link to Qualitative Responses](#)

Q9. What suggestions would you have for improvements at MSRI?

[Link to Qualitative Responses](#)

Q10. What suggestions would you have for future MSRI programs or workshops?

[Link to Qualitative Responses](#)

Q11. Professionally, my overall satisfaction with MSRI was		
1 - Least Satisfying	0	0%
2	0	0%
3	1	2%
4	4	9%
5 - Most Satisfying	38	88%
Total Responses (Exclusive of N/A)	43	100%

Q12. Should MSRI continue this program?

Yes	41	100%
No	0	0%
Total Responses	41	

MSRI Experience - Computing Services and Facilities

Q13. How would you rate the computing staff for the support you received while at MSRI		
1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	2	7%
5 - Most Satisfying	25	93%
Total Responses (Exclusive of N/A)	27	100%

Q14. How would you rate the computing equipment you used at MSRI:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	3	10%
5 - Most Satisfying	28	90%
Total Responses (Exclusive of N/A)	31	100%

Q15. How could we improve our computing services?[Link to Qualitative Responses](#)**Q16. How could we improve our computing equipment and software environment?**[Link to Qualitative Responses](#)**MSRI Experience - Administrative Support Services****Q17. How would you rate the administrative support you received while at MSRI**

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	3	7%
5 - Most Satisfying	40	93%
Total Responses (Exclusive of N/A)	43	100%

Q18. How could we improve our administrative services?[Link to Qualitative Responses](#)**MSRI Experience - Feedback****Q19. How has working in a female-only collaboration differed from other research collaborations?**[Link to Qualitative Responses](#)**Q20. How can MSRI help your research group in the future?**[Link to Qualitative Responses](#)**Q21. If applicable, how did the availability of family support affect your ability to participate in the program?**[Link to Qualitative Responses](#)**Q22. Your comments about MSRI:**[Link to Qualitative Responses](#)